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Before the
FEDERAL COMMUNICATIONS COMMISSION
 Washington, DC 20554

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FEDERAL COMMUNICATIONS COMMISSION
 OFFICE OF THE SECRETARY

In the Matter of)
)
 1998 Biennial Regulatory Review -- Amendment) ET Docket No. 98-42
 of Part 18 of the Commission's Rules to)
 Update Regulations for RF Lighting Devices)

To: The Commission

COMMENTS OF THE AMERICAN RADIO RELAY LEAGUE, INCORPORATED

The American Radio Relay League, Incorporated (the League), the national association of amateur radio operators, by counsel and pursuant to Section 1.415 of the Commission's Rules (47 C.F.R. §1.415), hereby respectfully submits its Comments in response to the *Notice of Proposed Rule Making* (the Notice), FCC 98-53, released April 9, 1998. The Notice proposes to amend Part 18 of the Commission's Rules to update its regulations for radio frequency (RF) Lighting Devices. In the interest of avoiding interference from such devices to stations in the Amateur Service, the League states as follows:

1. The Notice states that the Commission's intent in this proceeding is to reduce unnecessary regulatory burden on manufacturers of RF lighting devices, and to relax the line-conducted emission limits for these devices, and to adopt radiated emission limits for RF lighting devices above 1 GHz. It is noted that new RF lighting devices have been developed which operate at higher frequencies than earlier generations of such devices, which operated on HF frequencies.

2. The Notice cites a new General Electric RF lighting device which operates at 2.2-2.8

004

MHz, which has been operating pursuant to a waiver of current Part 18 regulations. GE studies show that the device will not cause interference unless located within 10 to 20 meters of a receiving station. The National Telecommunications and Information Administration (NTIA), however, was concerned about interference to Safety of Life at Sea (SOLAS) ships or coast stations, and asked for an advisory label on the devices noting possible interference. The Commission imposed that requirement. The Commission has received no interference complaints related to the GE lighting device. Thus, the Commission proposes to relax the consumer line-conducted emission limit in Section 18.307(c) by 22 dB in the 2.2-2.8 MHz band to the existing non-consumer level of 3000 uV.

3. As to microwave lighting devices, another company, Fusion Lighting, has developed a high-power RF lamp for commercial use that operates in the 2400-2500 MHz Industrial, Scientific and Medical (ISM) band. It is intended for use in large commercial areas, such as warehouses, parking lots, and shopping malls. The Commission says it forecasts the proliferation of such devices for outdoor lighting, such as street lighting. It is reportedly highly efficient, but does not comply with line-conducted limits for RF lighting devices. While the Commission does not propose to exempt such devices from conducted emission limits, and expresses an intention to prevent harmful interference from such devices to licensed services, it asks whether Section 18.307(c) of the Rules is appropriate for devices operating in the 2450 MHz ISM band. The Commission notes similarity between the RF power sources for the Fusion lighting devices and microwave ovens, and suggests that while microwave ovens are not subject to line-conducted emission limits, they typically produce emissions up to 10 dB above the line-conducted limits for non-consumer RF lighting devices. So, the Commission asks whether consumer line-

conducted limits in Section 18.307(c) should be relaxed 10 dB for RF lighting products.

4. Finally, the regulations for RF lighting devices in Section 18.305(c) do not include any radiated emissions limits above 1 GHz. The Fusion lamp radiates significant RF energy across a broad range of microwave frequencies. The Commission is concerned about interference to other services such as the Digital Audio Radio Service, at 2320-2345 MHz, and the Mobile Satellite Service at 2483.5-2500 MHz. The Notice proposes radiated emission limits above 1 GHz for RF lighting devices which are identical to those applicable to other digital devices: 100 uV/m for non-consumer devices and 50 uV/m for consumer equipment. No radiated emission limit would apply in ISM bands.

5. The League expresses no opinion herein relative to the Commission's proposal to relax the consumer line-conducted emission limits at 2.2-2.8 MHz, as that is not an amateur allocation. As a general matter, the League suggests that warning labels for such devices are exceptionally important, since these devices will be operating in consumer environments, including multiple-unit dwellings, where a consumer may subject immediate neighbors to RF interference. The requirement is obviously not burdensome to the manufacturers, and provides a basis for cooperative, private-sector interference resolution.

6. The Notice, at paragraph 11, asks specifically whether Section 18.307(c) of the Commission's Rules is "appropriate" for RF lighting products operating in the 2450 MHz band. However, in the present rule section, and in the Commission's proposed Section 18.307(c) in the Appendix to the Notice, there is no reference in the line-conducted limits to devices operating above 30 MHz. As there is no standard specified for a line-conducted limitation at 2450 MHz in the text of the rule, it is impossible to determine which line-conducted limit would

be appropriate for such devices.

7. As a substantive matter, the League is most concerned about the potential for interference from wideband, high-power 2450 MHz RF lighting devices to Amateur Service operations at 2300-2310 MHz, 2390-2400 MHz, 2400-2450 MHz, and the Amateur-Satellite Service operations at 2400-2402 MHz. This concern is heightened by the Commission's quite reasonable projection of the proliferation of these devices, and their applications in street lighting, for example. An ISM device is certainly not limited to commercial environments. Street lights, and the lighting of tennis courts, baseball fields and the like, anticipate not only elevated mounting of these devices, but as well their location in and proximate to residential areas, where amateur stations are principally located. While the energy-efficiency of these devices should be accommodated, the devices should be carefully regulated relative to their interference potential outside ISM bands.

8. Fusion has requested that line-conducted emission limits not apply above 1 GHz, so as to accommodate 2.4 GHz-band RF-lighting devices. They note that the filters that would be required to meet both FCC and UL requirements would add about 15% to the cost of manufacturing these devices. The League suggests that such cost is not excessive. Adding such filters to prevent interference to licensed radio services is a routine engineering criterion that is required of virtually all manufacturers who make products that intentionally or unintentionally radiate RF energy. At paragraph 11 of the Notice, the Commission notes that Fusion's lamps should not be exempted from line-conducted limits. The League supports this determination. Fusion has indicated that its device could meet limits that are 25 to 35 dB above the current non-consumer limits for ISM devices without adding additional filters. The Commission has

proposed that the limits for non-consumer ISM devices be relaxed 10 dB from the current limits. This 10-dB reduction, however, will not eliminate the need for filters, so only a portion of the 15% saved by not using a filter would be realized, further weakening the rationale for relaxation.

9. The currently proposed 2.4 GHz lighting devices use magnetron power sources. Much of the line-conducted emissions of these devices is in the ELF range, consisting primarily of harmonics of the ac-power-line frequency. The League does not object to relaxing the limits for frequencies below 100 kHz. However, manufacturers of magnetron-powered RF lighting devices should have little difficulty meeting the present conducted limits for frequencies above 100 kHz. Fusion has noted similarities between magnetron RF-lighting devices and magnetron microwave ovens. This analogy is flawed. Most microwave ovens are located in residential environments. Any line-conducted emissions are radiated very poorly from typical house wiring, often located near ground level, running into basements, etc., with additional attenuation offered by the building structure. In addition, there is a significant difference in the operating duty cycle of microwave ovens and RF lamps. A microwave oven is usually used for relatively short periods, followed by long periods during which there will be no interference. Lighting is usually used for long periods, during which time the interference will be continuous. RF lighting used as street lighting, moreover, would generally be located at elevated, unshielded locations. Visual observation of the power-line wiring associated with street lighting shows a wide range of wiring practices, often using "pigtailed" to connect various sections of secondary power lines and transformers. Many of these wiring practices appear to be reasonably efficient radiating elements above 1 GHz. This premise was verified in the League's laboratory, using NEC-4

antenna modeling software and a rudimentary model of the wiring and pigtails. When this model was fed with a 10,000 uV source at 2.4 GHz, the calculated near field at a height of 3 meters above ground was as much as 200 uV/meter, with the assumption that approximately 3 meters of power line would exhibit 6 dB of transmission line loss at 2.4 GHz. There are so many possible configurations of power-line wiring that could be used in conjunction with street lighting that it is not appropriate to consider relaxing the limits until measurements across a wide range of conditions can be made to properly assess the interference potential. It is likely that devices located near the top of utility poles will be much more efficient radiators than devices located inside of buildings. It is not appropriate, for the above reasons, to base the rationale for a 10-dB relaxation of the limits for devices that could be used for street lighting on the typical performance of microwave ovens.

10. The League agrees that it is necessary to extend the radiated-emission limits to frequencies above 1 GHz. However, a limit of 100 uV/m at 30 meters is not adequate to protect many radio services. The physical relationship between street lighting and typical amateur antenna installations is such that it is likely that the street lighting will be located in line-of-sight paths between amateur antennas and amateur satellites passing overhead. Typical amateur installations would be subject to interference from numerous broadband RF sources located in most directions. Many microwave stations use high-gain antennas. If, for example, a 20 dBi gain antenna (which is typical for amateur antennas in this frequency range) was located 30 meters from a source of this level, this would create -63 dBm at the antenna terminals. Amateur receivers typically have a noise floor of -154 dBm/kHz to -144 dBm/kHz. The low noise floor obtained with modern equipment is ideal for satellite operation. If an RF lighting device is used

as a street lamp in a residential area, assuming a magnetron bandwidth of 1 MHz, the interfering signal in the path of satellite communications would be 33 dB above the noise floor of an amateur receiver 300 meters away. Thus, devices operated at this power level would be a significant interference source.

11. The League requests that the Commission not permit these devices to be operated in residential areas or within 300 meters of residential areas, if it should proceed to adopt the relaxed conducted emission and radiated emission limits proposed in the Notice. There is, moreover, good reason not to relax the emission limitations as proposed for line-conducted emissions at 2.4 GHz.

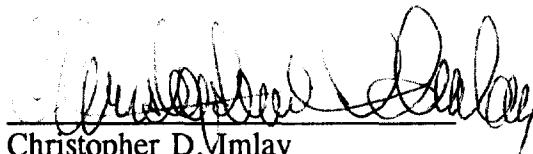
Therefore, the foregoing considered, the American Radio Relay League, Incorporated respectfully requests that the Commission incorporate the League's recommendations herein in any final Order adopted in this proceeding.

Respectfully submitted,

**THE AMERICAN RADIO RELAY LEAGUE,
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